CLAIMS

1. A method of processing image data defining a plurality of sequences of images, each from a respective camera, of a plurality of objects moving in a scene to produce signals defining representations of the objects in a three-dimensional computer model, the method comprising:

processing image data from a first of the cameras to identify image data relating to objects in the scene;

processing image data from a second of the cameras to identify image data relating to objects in the scene;

processing the identified image data from the first camera for each object to define an object representation in a modelling space having a height dependent upon the image data for the object from the first camera;

processing the identified image data from the second camera for each object to define an object representation in the modelling space having a height dependent upon the image data for the object from the second camera;

comparing the height of the representation of each object generated in dependence upon image data from the first camera with the height of the representation of the corresponding object generated in dependence upon image data from the second camera; and

generating object representations in the three-dimensional computer model in dependence upon the height

comparisons.

2. A method according to claim 1, wherein the modelling space in which the object representations are defined using image data from the first camera and image data from the second camera is the three-dimensional computer model.

3. A method according to claim 2, wherein the step of generating object representations in the three-dimensional computer model comprises modifying the taller representation when the heights of corresponding representations are not within a predetermined amount of each other.

4. A method according to claim 3, wherein, when the heights of corresponding representations are not within the predetermined amount of each other, the taller representation is modified to give a representation having a height based on the height of the smaller representation.

5. A method according to claim 3, wherein, when the heights of the corresponding representations are not within the predetermined amount of each other, a further representation is defined in the three-dimensional model using part of the image data from which the taller

representation was defined.

6. A method according to claim 5, wherein, when the heights of the corresponding representations are not within the predetermined amount of each other, the taller representation is split into a first portion having a height corresponding to the height of the smaller representation and a second portion comprising the remaining part of the taller representation, and wherein the further representation is defined by re-positioning the second portion in the three-dimensional model.

7. A method according to claim 6, wherein the second portion is re-positioned in dependence upon a representation defined on the basis of image data from the camera which produced the smaller representation.

8. A method according to claim 7, wherein the second portion is re-positioned by:

identifying which of the representations defined on the basis of image data from the camera which produced the smaller representation overlaps the image data used to define the taller representation in the image space of the camera which produced the taller representation; and

re-positioning the second portion in dependence upon the position of the identified representation in the

three-dimensional model.

9. A method according to claim 8, wherein the second portion is re-positioned by:

mapping at least part of each representation defined on the basis of image data from the camera which produced the smaller representation from the three-dimensional model to the image space of the camera which produced the taller representation;

determining which projected representation overlaps the image data for the taller representation in the image space of the camera which produced the taller representation; and

re-positioning the second portion in dependence upon the position in the three-dimensional model of the representation which, when projected into the image space of the camera which produced the taller representation, overlapped the image data for the taller representation.

10. A method according to claim 9, wherein the second portion is re-positioned so that the centre of its base is at the same position as the centre of the base of the representation which overlapped the image data for the taller representation.

11. A method according to claim 1, wherein each object representation is defined as a planar surface with its

base on a predetermined surface in the modelling space and with a position and size in dependence upon a polygon bounding the image data for the object.

12. A method according to claim 11, wherein the polygon is a rectangle.

13. A method according to claim 12, wherein the sides of the rectangle are parallel to the sides of the image.

14. A method according to claim 11, wherein the width of the planar surface is determined by the width of the bounding polygon in the image data, and the height of the planar surface is calculated using the aspect ratio of the bounding polygon in the image data.

15. A method according to claim 11, wherein the planar surface lies within a vertical plane.

16. A method according to claim 1, further comprising the step of generating image data by rendering an image of the three-dimensional computer model in which texture data based on the processed image data is rendered onto the representation of each object.

17. A method according to claim 16, further comprising the step of generating a signal conveying the image data.

18. A method according to claim 17, further comprising the step of recording the signal.

19. A method according to claim 16, further comprising the step of displaying an image of the objects using the generated image data.

20. A method according to claim 16, further comprising the step of making a recording of the image data either directly or indirectly.

21. A method of image processing in which image data from first and second cameras is processed to identify image data relating to respective objects, the height of each object in a modelling space is determined using the identified image data, and the heights of objects determined using image data from the first camera are compared with the heights of objects determined using image data from the second camera to determine which if any identified image data relates to more than one object.

22. An image processing method in which image data from a first camera of objects in a scene is processed to identify image data relating to respective objects, and image data from a second camera of the objects in the scene is processed to determine whether any of the

identified image data from the first camera relates to more than one object by comparing a size parameter of each object determined from the image data of the first camera with the corresponding size parameter determined from the image data of the second camera.

23. An image processing apparatus for processing image data defining a plurality of sequences of images, each from a respective camera, of a plurality of objects moving in a scene to produce signals defining representations of the objects in a three-dimensional computer model, the apparatus comprising:

means for processing image data from a first of the cameras to identify image data relating to objects in the scene;

means for processing image data from a second of the cameras to identify image data relating to objects in the scene;

means for processing the identified image data from the first camera for each object to define an object representation in a modelling space having a height dependent upon the image data for the object from the first camera;

means for processing the identified image data from the second camera for each object to define an object representation in the modelling space having a height dependent upon the image data for the object from the

second camera;

means for comparing the height of the representation of each object generated in dependence upon image data from the first camera with the height of the representation of the corresponding object generated in dependence upon image data from the second camera; and

means for generating object representations in the three-dimensional computer model in dependence upon the height comparisons.

24. Apparatus according to claim 23, wherein the modelling space in which the object representations are defined using image data from the first camera and image data from the second camera is the three-dimensional computer model.

25. Apparatus according to claim 24, wherein the means for generating object representations in the three-dimensional computer model comprises means arranged to modify the taller representation when the heights of corresponding representations are not within a predetermined amount of each other.

26. Apparatus according to claim 25, arranged to perform processing such that, when the heights of corresponding representations are not within the predetermined amount of each other, the taller representation is modified to

give a representation having a height based on the height of the smaller representation.

27. Apparatus according to claim 25, arranged to perform processing such that, when the heights of the corresponding representations are not within the predetermined amount of each other, a further representation is defined in the three-dimensional model using part of the image data from which the taller representation was defined.

28. Apparatus according to claim 27, arranged to perform processing such that, when the heights of the corresponding representations are not within the predetermined amount of each other, the taller representation is split into a first portion having a height corresponding to the height of the smaller representation and a second portion comprising the remaining part of the taller representation, and wherein the further representation is defined by re-positioning the second portion in the three-dimensional model.

29. Apparatus according to claim 28, arranged to perform processing such that the second portion is re-positioned in dependence upon a representation defined on the basis of image data from the camera which produced the smaller representation.

30. Apparatus according to claim 29, arranged to perform processing such that the second portion is re-positioned by:

identifying which of the representations defined on the basis of image data from the camera which produced the smaller representation overlaps the image data used to define the taller representation in the image space of the camera which produced the taller representation; and

re-positioning the second portion in dependence upon the position of the identified representation in the three-dimensional model.

31. Apparatus according to claim 30, arranged to perform processing such that the second portion is re-positioned by:

mapping at least part of each representation defined on the basis of image data from the camera which produced the smaller representation from the three-dimensional model to the image space of the camera which produced the taller representation;

determining which projected representation overlaps the image data for the taller representation in the image space of the camera which produced the taller representation; and

re-positioning the second portion in dependence upon the position in the three-dimensional model of the

representation which, when projected into the image space of the camera which produced the taller representation, overlapped the image data for the taller representation.

32. Apparatus according to claim 31, arranged to perform processing such that the second portion is re-positioned so that the centre of its base is at the same position as the centre of the base of the representation which overlapped the image data for the taller representation.

33. Apparatus according to claim 23, arranged to perform processing such that each object representation is defined as a planar surface with its base on a predetermined surface in the modelling space and with a position and size in dependence upon a polygon bounding the image data for the object.

34. Apparatus according to claim 33, wherein the polygon is a rectangle.

35. Apparatus according to claim 34, wherein the sides of the rectangle are parallel to the sides of the image.

36. Apparatus according to claim 33, arranged to perform processing such that the width of the planar surface is determined by the width of the bounding polygon in the image data, and the height of the planar surface is

calculated using the aspect ratio of the bounding polygon in the image data.

37. Apparatus according to claim 33, arranged to perform processing such that the planar surface lies within a vertical plane.

38. Apparatus according to claims 23, further comprising means for generating image data by rendering an image of the three-dimensional computer model in which texture data based on the processed image data is rendered onto the representation of each object.

39. Apparatus according to claim 38 further comprising means for displaying an image of the objects using the generated image data.

40. An image processing apparatus operable to process image data from first and second cameras to identify image data relating to respective objects, to determine the height of each object in a modelling space using the identified image data, and to compare the heights of objects determined using image data from the first camera with the heights of objects determined using image data from the second camera to determine which if any identified image data relates to more than one object.

41. An image processing apparatus operable to process image data from a first camera of objects in a scene to identify image data relating to respective objects, and to process image data from a second camera of the objects in the scene to determine whether any of the identified image data from the first camera relates to more than one object by comparing a size parameter of each object determined from the image data of the first camera with the corresponding size parameter determined from the image data of the second camera.

42. A storage medium storing instructions for causing a programmable processing apparatus to perform a method according to ~~any of~~ claim~~s~~ 1 ~~to 22~~.

43. A signal conveying instructions for causing a programmable processing apparatus to perform a method according to ~~any of~~ claim~~s~~ 1 ~~to 22~~.

44. A method of processing image data defining a plurality of sequences of images, each from a respective camera, of an object moving in a scene to produce signals defining a representation of the object in a three-dimensional computer model, the method comprising:

processing image data from a first of the cameras to identify image data relating to the object in the scene;

processing image data from a second of the cameras to identify image data relating to the object in the scene;

applying a transformation to the identified image data from the first camera which defines a mapping from the ground plane in the space of the image data of the first camera to a surface in a modelling space;

applying a transformation to the identified image data from the second camera which defines a mapping from the ground plane in the space of the image data of the second camera to the surface in the modelling space;

comparing the transformed image data from the first and second cameras on the surface in the modelling space;

determining which part of the image data represents shadow in dependence upon the comparison results; and

generating a representation of at least the object in the three-dimensional model.

45. A method according to claim 44, further comprising the step of generating a representation of the shadow in the three-dimensional model.

46. A method according to claim 44, wherein the surface in the modelling space is the ground plane in the three-dimensional model.

47. A method according to claim 44, wherein it is

determined that aligned parts of the transformed image data represent shadow.

48. A method according to claim 44, further comprising the step of generating image data by rendering an image of the three-dimensional computer model in which texture data based on the processed image data is rendered onto the representation of the object.

49. A method according to claim 48, wherein the image data rendered onto the representation is determined in dependence upon the comparison results.

50. A method according to claim 48, further comprising the step of generating a signal conveying the image data.

51. A method according to claim 50, further comprising the step of recording the signal.

52. A method according to claim 48, further comprising the step of displaying an image of the object using the generated image data.

53. A method according to claim 48, further comprising the step of making a recording of the image data either directly or indirectly.

54. A method of generating a model of an object in a three-dimensional computer model by processing images of the object from a plurality of cameras, in which image data from a first camera is processed to identify image data relating to the object and its shadow together, and image data from a second camera is used to determine the identified image data from the first camera which relates to the shadow and the identified image data from the first camera which relates to the object.

55. A method of generating a model of an object in a three-dimensional computer model, in which:

a transformation is applied to image data from a first camera relating to the object and its shadow which maps the image data for one of the object and its shadow to a surface;

a transformation is applied to image data from a second camera relating to the object and its shadow which maps the image data for one of the object and its shadow to the surface; and

the object is modelled in dependence upon part of the transformed image data.

56. Apparatus for processing image data defining a plurality of sequences of images, each from a respective camera, of an object moving in a scene to produce signals defining a representation of the object in a three-

dimensional computer model, the apparatus comprising:

means for processing image data from a first of the cameras to identify image data relating to the object in the scene;

means for processing image data from a second of the cameras to identify image data relating to the object in the scene;

means for applying a transformation to the identified image data from the first camera which defines a mapping from the ground plane in the space of the image data of the first camera to a surface in a modelling space;

means for applying a transformation to the identified image data from the second camera which defines a mapping from the ground plane in the space of the image data of the second camera to the surface in the modelling space;

means for comparing the transformed image data from the first and second cameras on the surface in the modelling space;

means for determining which part of the image data represents shadow in dependence upon the comparison results; and

means for generating a representation of at least the object in the three-dimensional model.

57. Apparatus according to claim 56, further comprising

means for generating a representation of the shadow in the three-dimensional model.

58. Apparatus according to claim 56, wherein the surface in the modelling space is the ground plane in the three-dimensional model.

59. Apparatus according to claim 56, arranged such that it is determined that aligned parts of the transformed image data represent shadow.

60. Apparatus according to claim 56, further comprising means for generating image data by rendering an image of the three-dimensional computer model in which texture data based on the processed image data is rendered onto the representation of the object.

61. Apparatus according to claim 60, wherein the image data rendered onto the representation is determined in dependence upon the comparison results.

62. Apparatus according to claim 60, further comprising means for displaying an image of the object using the generated image data.

63. Apparatus for generating a model of an object in a three-dimensional computer model by processing images of

the object from a plurality of cameras, the apparatus being operable to process image data from a first camera to identify image data relating to the object and its shadow together, and operable to use image data from a second camera to determine the identified image data from the first camera which relates to the shadow and the identified image data from the first camera which relates to the object.

64. Apparatus for generating a model of an object in a three-dimensional computer model, comprising:

means for applying a transformation to image data from a first camera relating to the object and its shadow which maps the image data for one of the object and its shadow to a surface;

means for applying a transformation to image data from a second camera relating to the object and its shadow which maps the image data for one of the object and its shadow to the surface; and

means for modelling the object in dependence upon part of the transformed image data.

65. A storage medium storing instructions for causing a programmable processing apparatus to perform a method according to ~~any of~~ claims 44 ~~to 55~~.

66. A signal conveying instructions for causing a

programmable processing apparatus to perform a method according to ~~any of~~ claims 44 ~~to 55~~.

67. A method of processing image data defining a plurality of sequences of images, each from a respective camera, of an object moving in a scene to produce signals defining a representation of the object in a three-dimensional computer model, the method comprising:

processing image data from a first of the cameras to identify image data relating to the object in the scene;

processing image data from a second of the cameras to identify image data relating to the object in the scene;

processing the identified image data from the first camera and the identified image data from the second camera to determine a footprint of the object on the ground; and

defining a model of the object in the three-dimensional computer model in dependence upon the determined footprint.

68. A method according to claim 67, wherein the step of processing the identified image data to determine the footprint of the object on the ground comprises:

applying a transformation to the identified image data from the first camera which defines a mapping from

the ground plane in the image data of the first camera to a surface in a modelling space;

applying a transformation to the identified image data from the second camera which defines a mapping from the ground plane in the image data of the second camera to the surface in the modelling space; and

comparing the transformed image data on the surface in the modelling space.

69. A method according to claim 68, wherein the surface in the modelling space is the ground plane in the three-dimensional computer model.

70. A method according to claim 68, wherein the outline of the image on the ground is determined in dependence upon the aligned and non-aligned portions of the transformed image data on the surface in the modelling space.

71. A method according to claim 67, wherein, the step of defining the model of the object comprises defining the model using a plurality of vertical planar surfaces.

72. A method according to claim 71, wherein the vertical planar surfaces are defined such that their bases approximate the outline of the object on the ground.

73. A method according to claim 71, wherein each planar surface is a rectangle.

74. A method according to claim 71, wherein each planar surface is defined with a height determined in dependence upon the image data identified from the first camera or the image data identified from the second camera.

75. A method according to claim 74, wherein the height of each planar surface is defined in dependence upon a rectangle bounding some or all of the image data relating to the object identified from the first camera or the second camera.

76. A method according to claim 74, wherein each planar surface is defined to have the same height.

77. A method according to claim 71, further comprising the step of generating a top for the model of the object in dependence upon upper edges of the vertical planar surfaces.

78. A method according to claim 67, further comprising the step of generating image data by rendering an image of the modelled object, in which texture data based on the identified image data from at least one camera is rendered onto the model.

79. A method according to claim 78, wherein each planar surface is mapped onto the image data of the first camera or the second camera, and the image data enclosed by each mapped surface is rendered onto the planar surface in the model.

80. A method according to claim 78, further comprising the step of generating a signal conveying the image data.

81. A method according to claim 80, further comprising the step of recording the signal.

82. A method according to claim 78, further comprising the step of displaying an image of the object using the generated image data.

83. A method according to claim 78, further comprising the step of making a recording of the image data either directly or indirectly.

84. A method of generating a model of an object in a three-dimensional computer model by processing images of the object from a plurality of cameras, in which image data from a first camera is processed to identify image data relating to the object, image data from a second camera is used to determine which parts of the identified image data from the first camera relate to parts of the

object on or near the ground, and the object is represented in the computer model in dependence thereon.

85. Apparatus for processing image data defining a plurality of sequences of images, each from a respective camera, of an object moving in a scene to produce signals defining a representation of the object in a three-dimensional computer model, the apparatus comprising:

means for processing image data from a first of the cameras to identify image data relating to the object in the scene;

means for processing image data from a second of the cameras to identify image data relating to the object in the scene;

means for processing the identified image data from the first camera and the identified image data from the second camera to determine a footprint of the object on the ground; and

means for defining a model of the object in the three-dimensional computer model in dependence upon the determined footprint.

86. Apparatus according to claim 85, wherein the means for processing the identified image data to determine the footprint of the object on the ground comprises:

means for applying a transformation to the identified image data from the first camera which defines

a mapping from the ground plane in the image data of the first camera to a surface in a modelling space;

means for applying a transformation to the identified image data from the second camera which defines a mapping from the ground plane in the image data of the second camera to the surface in the modelling space; and

means for comparing the transformed image data on the surface in the modelling space.

87. Apparatus according to claim 86, wherein the surface in the modelling space is the ground plane in the three-dimensional computer model.

88. Apparatus according to claim 86, arranged to determine the outline of the image on the ground in dependence upon the aligned and non-aligned portions of the transformed image data on the surface in the modelling space.

89. Apparatus according to claim 85, wherein, the means for defining the model of the object comprises means for defining the model using a plurality of vertical planar surfaces.

90. Apparatus according to claim 89, arranged to perform processing such that the vertical planar surfaces are

defined such that their bases approximate the outline of the object on the ground.

91. Apparatus according to claim 89, wherein each planar surface is a rectangle.

92. Apparatus according to claim 89, arranged to perform processing such that each planar surface is defined with a height determined in dependence upon the image data identified from the first camera or the image data identified from the second camera.

93. Apparatus according to claim 92, arranged to perform processing such that the height of each planar surface is defined in dependence upon a rectangle bounding some or all of the image data relating to the object identified from the first camera or the second camera.

94. Apparatus according to claim 92, wherein each planar surface is defined to have the same height.

95. Apparatus according to claim 89, further comprising means for generating a top for the model of the object in dependence upon upper edges of the vertical planar surfaces.

96. Apparatus according to claim 85, further comprising

the step of generating image data by rendering an image of the modelled object, in which texture data based on the identified image data from at least one camera is rendered onto the model.

97. Apparatus according to claim 96, arranged to perform processing such that each planar surface is mapped onto the image data of the first camera or the second camera, and the image data enclosed by each mapped surface is rendered onto the planar surface in the model.

98. Apparatus according to claim 96, further comprising means for displaying an image of the object using the generated image data.

99. Apparatus for generating a model of an object in a three-dimensional computer model by processing images of the object from a plurality of cameras, the apparatus being operable to process image data from a first camera to identify image data relating to the object, to use image data from a second camera to determine which parts of the identified image data from the first camera relate to parts of the object on or near the ground, and to represent the object in the computer model in dependence thereon.

100. A storage medium storing instructions for causing

a programmable processing apparatus to perform a method according to ~~any of~~ claims 67 ~~to 84~~.

101. A signal conveying instructions for causing a programmable processing apparatus to perform a method according to ~~any of~~ claims 67 ~~to 84~~.

102. A method of processing image data defining a sequence of images of a plurality of objects moving in a scene to produce signals defining representations of the objects in a three-dimensional computer model, and to generate image data by rendering an image of the three-dimensional computer model in accordance with a user-selected viewing direction, the method comprising:

processing the image data to identify image data relating to respective objects in the scene;

defining a representation of each object in the three-dimensional computer model, in dependence upon the identified image data; and

generating image data by rendering an image of the three-dimensional computer model in accordance with a user-selected viewing direction, wherein, when the selected viewing direction is within a predetermined range of viewing directions, texture data based on the identified image data is rendered onto the object representations, and, when the selected viewing direction is not within the predetermined range of viewing

directions, a schematic of the positions of the objects in the scene is rendered.

103. A method according to claim 102, wherein the representation of each object comprises a plurality of vertical planar surfaces alone.

104. A method according to claim 102, wherein the representation of each object comprises a single vertical planar surface.

105. A method according to claim 102, wherein the predetermined range of viewing directions is a range relative to a fixed direction in the computer model.

106. A method according to claim 105, wherein the predetermined range of viewing direction is a range relative to the vertical direction in the computer model.

107. A method according to claim 102, wherein the predetermined range of viewing directions is a range relative to the representation of an object.

108. A method according to claim 107, wherein the representation of an object comprises at least one vertical planar surface, and the predetermined range of viewing directions is a range relative to a planar

surface.

109. A method according to claim 102, wherein the schematic of the object positions is rendered from a predetermined viewing direction.

110. A method according to claim 109, wherein the schematic is rendered from a vertical downward viewing direction.

111. A method according to claim 102, further comprising the steps of processing the image data to determine at least one colour for each object, and generating image data to indicate the determined colour on the schematic of the object positions.

112. A method according to claim 102, further comprising the step of generating a signal conveying the image data.

113. A method according to claim 112, further comprising the step of recording the signal.

114. A method according to claim 102, further comprising the step of displaying an image of the objects using the generated image data.

115. A method according to claims 102, further comprising

the step of making a recording of the image data either directly or indirectly.

116. A method of rendering an image in accordance with a user-selected viewing direction of a three-dimensional computer model comprising a representation and associated texture data for an object, the texture data being derived from image data recorded by at least one camera, the method comprising:

rendering the texture data onto the representation for the object in accordance with the user-selected viewing direction when the user-selected viewing direction is within a predetermined range of viewing directions; and

rendering a schematic of the positions of the object when the user-selected viewing direction is not within the predetermined range of viewing directions.

117. An image processing method in which object data defining a three-dimensional computer model of a plurality of objects in a scene is processed to generate image data for an image of the objects and the scene such that:

in response to a first user input, the objects and the scene are rendered in accordance with a selected viewing direction; and

in response to a second user input, image data is

rendered for an image in which the positions of the objects in the scene are represented.

118. Apparatus for processing image data defining a sequence of images of a plurality of objects moving in a scene to produce signals defining representations of the objects in a three-dimensional computer model, and to generate image data by rendering an image of the three-dimensional computer model in accordance with a user-selected viewing direction, the apparatus comprising:

means for processing the image data to identify image data relating to respective objects in the scene;

means for defining a representation of each object in the three-dimensional computer model, in dependence upon the identified image data; and

means for generating image data by rendering an image of the three-dimensional computer model in accordance with a user-selected viewing direction, operable such that, when the selected viewing direction is within a predetermined range of viewing directions, texture data based on the identified image data is rendered onto the object representations, and, when the selected viewing direction is not within the predetermined range of viewing directions, a schematic of the positions of the objects in the scene is rendered.

119. Apparatus according to claim 118, operable to perform processing such that the representation of each object comprises a plurality of vertical planar surfaces alone.

120. Apparatus according to claim 118, operable to perform processing such that the representation of each object comprises a single vertical planar surface.

121. Apparatus according to claim 118, operable to perform processing such that the predetermined range of viewing directions is a range relative to a fixed direction in the computer model.

122. Apparatus according to claim 121, operable to perform processing such that the predetermined range of viewing direction is a range relative to the vertical direction in the computer model.

123. Apparatus according to claim 118, operable to perform processing such that the predetermined range of viewing directions is a range relative to the representation of an object.

124. Apparatus according to claim 123, operable to perform processing such that the representation of an object comprises at least one vertical planar surface,

and the predetermined range of viewing directions is a range relative to a planar surface.

125. Apparatus according to claim 118, operable to perform processing such that the schematic of the object positions is rendered from a predetermined viewing direction.

126. A method according to claim 125, operable to perform processing such that the schematic is rendered from a vertical downward viewing direction.

127. Apparatus according to claim 118, further comprising means for processing the image data to determine at least one colour for each object, and means for generating image data to indicate the determined colour on the schematic of the object positions.

128. Apparatus according to claim 118, further comprising means for displaying an image of the objects using the generated image data.

129. Apparatus for rendering an image in accordance with a user-selected viewing direction of a three-dimensional computer model comprising a representation and associated texture data for an object, the texture data being derived from image data recorded by at least one camera,

the apparatus comprising:

means for rendering the texture data onto the representation for the object in accordance with the user-selected viewing direction when the user-selected viewing direction is within a predetermined range of viewing directions; and

means for rendering a schematic of the positions of the object when the user-selected viewing direction is not within the predetermined range of viewing directions.

130. An image processing apparatus operable to process object data defining a three-dimensional computer model of a plurality of objects in a scene to generate image data for an image of the objects using first and second techniques such that:

in the first technique, the objects and the scene are rendered in accordance with a viewing direction; and

in the second technique, image data is rendered for a schematic image in which the positions of the objects in the scene are represented.

131. A storage medium storing instructions for causing a programmable processing apparatus to perform a method according to ~~any of~~ claims 102 ~~to 117~~.

132. A signal conveying instructions for causing a programmable processing apparatus to perform a method

A according to ~~any of~~ claims 102 ~~to 117~~.

133. A method of processing image data defining a plurality of sequences of images, each from a respective camera, of an object moving in a scene to produce signals defining a representation of the object in a three-dimensional computer model, the method comprising:

processing image data from a first of the cameras to identify image data relating to the object in the scene;

processing image data from a second of the cameras to identify image data relating to the object in the scene;

processing the identified image data from the first camera and the identified image data from the second camera to identify planar surfaces on which points on the object lie by matching feature points in the identified image data from the first camera with feature points in the identified image data from the second camera, and identifying planar surfaces on which matched feature points lie; and

defining a model of the object in the three-dimensional computer model in dependence upon the identified planar surfaces.

134. A method according to claim 133, wherein corner points in the identified image data from the first camera

are matched with corner points in the identified image data from the second camera.

135. A method according to claim 133, wherein the planar surfaces are identified by identifying planes on which the matched feature points lie, and determining boundaries of the planes using matched feature points which lie on more than one plane.

136. A method according to claim 135, wherein each plane is identified by identifying a plane on which at least a predetermined number of feature points in the identified image data from the first camera lie, identifying the plane on which the matched feature points in the identified image data from the second camera lie, calculating a transformation between the plane in the image data from the first camera and the plane in the image data from the second camera, and testing the transformation using a plurality of other matched pairs of feature points.

137. A method according to claim 136, wherein the predetermined number is four.

138. A method according to claim 133, wherein the step of defining the model of the object comprises forming a model of planar surfaces in the three-dimensional

computer model, each planar surface in the model corresponding to a planar surface identified in the image data from at least one of the cameras.

139. A method according to claim 138, wherein the step of defining the model of the object comprises identifying a planar surface which touches the ground in the image data of a camera, defining a vertical planar surface in the three-dimensional computer model in dependence upon the identified planar surface which touches the ground, and defining a further planar surface in the three-dimensional computer model for each further planar surface in the image data of the camera such that the planar surfaces in the three-dimensional computer model and the image data have the same aspect ratio.

140. A method according to claim 139, wherein a planar surface which touches the ground in the image data of the given camera is identified by:

applying a transformation to the base corner points of planar surfaces in the image data from the first camera which defines a mapping from the ground plane in the image data of the first camera to a surface in a modelling space;

applying a transformation to the base corner points of planar surfaces in the image data from the second camera which defines a mapping from the ground plane in

the image data of the second camera to the surface in the modelling space; and

comparing the transformed corner points to determine which ones lie within a predetermined distance of each other.

141. A method according to claim 140, wherein the surface in the modelling space is the ground plane in the three-dimensional computer model.

142. A method according to claim 141, wherein the defined vertical planar surface in the three-dimensional computer model is defined with a base defined by transformed corner points from the given camera which lie within the predetermined distance of the corresponding transformed corner points from the other camera, and with an aspect ratio corresponding to the aspect ratio of the planar surface in the image data of the given camera to which the transformed corner points belong.

143. A method according to claim 133, further comprising the step of generating image data by rendering an image of the modelled object, in which texture data based on the identified image data from at least one camera is rendered onto the model.

144. A method according to claim 143, wherein image data

enclosed by each planar surface is rendered on the corresponding planar surface of the object model.

145. A method according to claim 143, further comprising the step of generating a signal conveying the image data.

146. A method according to claim 145, further comprising the step of recording the signal.

147. A method according to claim 143, further comprising the step of displaying an image of the object using the generated image data.

148. A method according to claim 143, further comprising the step of making a recording of the image data either directly or indirectly.

149. A method of generating a model of an object in a three-dimensional computer model by processing images of the object from a plurality of cameras, in which image data from a first camera and a second camera is processed to match feature points in the image data from the first camera with feature points in image data from the second camera, the resulting matches are used to determine planar surfaces making up the object, and the object is represented in the computer model in dependence thereon.

150. Apparatus for processing image data defining a plurality of sequences of images, each from a respective camera, of an object moving in a scene to produce signals defining a representation of the object in a three-dimensional computer model, the apparatus comprising:

means for processing image data from a first of the cameras to identify image data relating to the object in the scene;

means for processing image data from a second of the cameras to identify image data relating to the object in the scene;

means for processing the identified image data from the first camera and the identified image data from the second camera to identify planar surfaces on which points on the object lie, comprising means for matching feature points in the identified image data from the first camera with feature points in the identified image data from the second camera, and means for identifying planar surfaces on which matched feature points lie; and

means for defining a model of the object in the three-dimensional computer model in dependence upon the identified planar surfaces.

151. Apparatus according to claim 150, operable to perform processing such that corner points in the identified image data from the first camera are matched with corner points in the identified image data from the

second camera.

152. Apparatus according to claim 150, operable to perform processing such that the planar surfaces are identified by identifying planes on which the matched feature points lie, and determining boundaries of the planes using matched feature points which lie on more than one plane.

153. Apparatus according to claim 152, operable to perform processing such that each plane is identified by identifying a plane on which at least a predetermined number of feature points in the identified image data from the first camera lie, identifying the plane on which the matched feature points in the identified image data from the second camera lie, calculating a transformation between the plane in the image data from the first camera and the plane in the image data from the second camera, and testing the transformation using a plurality of other matched pairs of feature points.

154. Apparatus according to claim 153, wherein the predetermined number is four.

155. Apparatus according to claim 150, wherein the means for defining the model of the object comprises means for forming a model of planar surfaces in the three-

dimensional computer model, each planar surface in the model corresponding to a planar surface identified in the image data from at least one of the cameras.

156. Apparatus according to claim 155, wherein the means for defining the model of the object comprises means for identifying a planar surface which touches the ground in the image data of a camera, means for defining a vertical planar surface in the three-dimensional computer model in dependence upon the identified planar surface which touches the ground, and means for defining a further planar surface in the three-dimensional computer model for each further planar surface in the image data of the camera such that the planar surfaces in the three-dimensional computer model and the image data have the same aspect ratio.

157. Apparatus according to claim 156, operable to perform processing such that a planar surface which touches the ground in the image data of the given camera is identified by:

applying a transformation to the base corner points of planar surfaces in the image data from the first camera which defines a mapping from the ground plane in the image data of the first camera to a surface in a modelling space;

applying a transformation to the base corner points

of planar surfaces in the image data from the second camera which defines a mapping from the ground plane in the image data of the second camera to the surface in the modelling space; and

comparing the transformed corner points to determine which ones lie within a predetermined distance of each other.

158. Apparatus according to claim 157, wherein the surface in the modelling space is the ground plane in the three-dimensional computer model.

159. Apparatus according to claim 158, operable to perform processing such that the defined vertical planar surface in the three-dimensional computer model is defined with a base defined by transformed corner points from the given camera which lie within the predetermined distance of the corresponding transformed corner points from the other camera, and with an aspect ratio corresponding to the aspect ratio of the planar surface in the image data of the given camera to which the transformed corner points belong.

160. Apparatus according to claim 150, further comprising means for generating image data by rendering an image of the modelled object, in which texture data based on the identified image data from at least one camera is

rendered onto the model.

161. Apparatus according to claim 160, operable to perform processing such that image data enclosed by each planar surface is rendered on the corresponding planar surface of the object model.

162. Apparatus according to claim 160, further comprising means for displaying an image of the object using the generated image data.

163. Apparatus for generating a model of an object in a three-dimensional computer model by processing images of the object from a plurality of cameras, the apparatus being operable to process image data from a first camera and a second camera to match feature points in the image data from the first camera with feature points in the image data from the second camera, to use the resulting matches to determine planar surfaces making up the object, and to represent the object in the computer model in dependence thereon.

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164. A storage medium storing instructions for causing a programmable processing apparatus to perform a method according to ~~any of~~ claims 133 ~~to 149~~.

165. A signal conveying instructions for causing a

programmable processing apparatus to perform a method according to ~~any of~~ claims 133 ~~to 149~~.

166. A method of processing image data defining a sequence of images of at least one object moving in a scene to produce signals defining a representation of each object in a three-dimensional computer model, and to generate image data by rendering an image of the three-dimensional computer model in accordance with a user-selected viewing direction, the method comprising:

processing the image data to identify image data relating to respective objects in the scene;

defining a representation of each object in the three-dimensional computer model in dependence upon the identified image data;

generating image data by rendering an image of the three-dimensional computer model in accordance with a user-selected viewing direction in which texture data based on the identified image data is rendered onto the object representations; and

generating quality information for the image data indicating a quality of the image data determined in dependence upon the user-selected viewing direction.

167. A method according to claim 166, wherein the step of generating quality information for the image includes generating information indicating the reliability of the

image data in dependence upon the angle between the user-selected viewing direction and the viewing direction from which the input image data was recorded.

168. A method according to claim 167, wherein the information indicating the reliability is generated in dependence upon a linear relationship between quality and the angular difference between the user-selected viewing direction and the viewing direction from which the input image data was recorded.

169. A method according to claim 167, further comprising the step of generating information indicating how to change the viewing direction to improve the generated reliability.

170. A method according to claim 166, wherein image data for a sequence of images recorded by a first camera and a sequence of images recorded by a second camera are processed such that:

in the step of processing the image data, image data from the first camera relating to the respective objects in the scene is identified, and image data from the second camera relating to the respective objects in the scene is identified;

in the step of defining a representation of each object, a first representation of each object is defined

in dependence upon the identified image data from the first camera, and a second representation of each object is defined in dependence upon the identified image data from the second camera; and

in the step of generating image data, texture data based on the identified image data from at least one camera is rendered onto the object representations.

171. A method according to claim 166, wherein, in the step of defining a representation of each object, each object is represented as a planar surface.

172. A method according to claim 166, wherein the quality information is generated as pixel data within the generated image data.

173. A method according to claims 166, further comprising the step of generating a signal conveying the image data and the quality information.

174. A method according to claim 173, further comprising the step of recording the signal.

175. A method according to claim 166, further comprising the step of displaying an image using the generated image data and displaying the quality information.

176. A method according to claim 166, further comprising the step of making a recording of the image data and the quality information either directly or indirectly.

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177. A method of rendering an image in accordance with a user-selected viewing direction of a three-dimensional computer model comprising a representation and associated texture data for at least one object, the texture data being derived from image data recorded by at least one camera, the method comprising:

generating image data by rendering an image of the three-dimensional computer model in accordance with a user-selected viewing direction, in which the texture data is rendered onto each representation; and

generating quality information for the image data indicating a quality of the image data determined in dependence upon the user-selected viewing direction.

178. An image processing method in which object data defining a three-dimensional computer model of at least one object in a scene is rendered in accordance with a user-selected viewing direction using image data recorded by a camera to render each object, and an indicator of a quality of the generated image data is produced for output to the user.

179. Apparatus for processing image data defining a

sequence of images of at least one object moving in a scene to produce signals defining a representation of each object in a three-dimensional computer model, and to generate image data by rendering an image of the three-dimensional computer model in accordance with a user-selected viewing direction, the apparatus comprising:

means for processing the image data to identify image data relating to respective objects in the scene;

means for defining a representation of each object in the three-dimensional computer model in dependence upon the identified image data;

means for generating image data by rendering an image of the three-dimensional computer model in accordance with a user-selected viewing direction in which texture data based on the identified image data is rendered onto the object representations; and

means for generating quality information for the image data indicating a quality of the image data determined in dependence upon the user-selected viewing direction.

180. Apparatus according to claim 179, wherein the means for generating quality information for the image comprises means for generating information indicating the reliability of the image data in dependence upon the angle between the user-selected viewing direction and the

viewing direction from which the input image data was recorded.

181. Apparatus according to claim 180, operable to perform processing such that the information indicating the reliability is generated in dependence upon a linear relationship between quality and the angular difference between the user-selected viewing direction and the viewing direction from which the input image data was recorded.

182. Apparatus according to claim 180, further comprising means for generating information indicating how to change the viewing direction to improve the generated reliability.

183. Apparatus according to claim 179, operable to process image data for a sequence of images recorded by a first camera and a sequence of images recorded by a second camera, wherein:

the means for processing the image data is operable to identify image data from the first camera relating to the respective objects in the scene and to identify image data from the second camera relating to the respective objects in the scene;

the means for defining a representation of each object is operable to define a first representation of

each object in dependence upon the identified image data from the first camera, and to define a second representation of each object in dependence upon the identified image data from the second camera; and

the means for generating image data is operable to render texture data based on the identified image data from at least one camera onto the object representations.

184. Apparatus according to claim 179, wherein the means for defining a representation of each object is arranged to represent each object as a planar surface.

185. Apparatus according to claim 179, operable to perform processing such that the quality information is generated as pixel data within the generated image data.

186. Apparatus according to claim 179, further comprising means for displaying an image using the generated image data and displaying the quality information.

187. Apparatus for rendering an image in accordance with a user-selected viewing direction of a three-dimensional computer model comprising a representation and associated texture data for at least one object, the texture data being derived from image data recorded by at least one camera, the apparatus comprising:

means for generating image data by rendering an

image of the three-dimensional computer model in accordance with a user-selected viewing direction, in which the texture data is rendered onto each representation; and

means for generating quality information for the image data indicating a quality of the image data determined in dependence upon the user-selected viewing direction.

188. An image processing apparatus operable to render object data defining a three-dimensional computer model of at least one object in a scene in accordance with a user-selected viewing direction using image data recorded by a camera to render each object, and operable to produce an indicator of a quality of the generated image data for output to the user.

189. A storage medium storing instructions for causing a programmable processing apparatus to perform a method according to ~~any of~~ claims 166 ~~to 170~~.

190. A signal conveying instructions for causing a programmable processing apparatus to perform a method according to ~~any of~~ claims 166 ~~to 170~~.

191. A method of processing image data defining a plurality of sequences of images, each from a respective

camera, of at least one object moving in a scene to produce signals defining a representation of each object in a three-dimensional computer model, and to generate image data by rendering an image of the three-dimensional computer model in accordance with a user-selected viewing direction, the method comprising:

processing input image data from at least one camera to define at least one representation of each object in the three-dimensional computer model; and

generating image data by rendering an image of the three-dimensional computer model in accordance with the user-selected viewing direction, in which texture data based on input image data is rendered onto a representation of each object;

wherein:

the representation of each object rendered is determined in dependence upon the user-selected viewing direction, the respective viewing directions of cameras, and at least one camera characteristic affecting image data quality.

192. A method according to claim 191, wherein the representation of each object rendered is determined in dependence upon the user-selected viewing direction, the viewing direction of respective cameras, and at least one of: the methods of transferring the image data from respective cameras; the resolution of respective cameras;

the shutter speed of respective cameras; the stability of the image data from respective cameras; and whether the image data from respective cameras is colour or black and white.

193. A method according to claim 191, wherein the user-selected viewing direction is input prior to the step of defining the object representations, and wherein one representation of each object is defined using the image data from one camera, the one camera being selected in dependence upon the user-selected viewing direction, the viewing direction of respective cameras, and at least one camera characteristic affecting image data quality.

194. A method according to claim 191, wherein image data from a first camera is processed to define a first representation of each object in the three-dimensional computer model, image data from a second camera is processed to define a second representation of each object in the three-dimensional computer model, and either the first representations or the second representations are selected for rendering in dependence upon the user-selected viewing direction, the viewing direction of the first and second cameras, and at least one camera characteristic affecting image data quality.

195. A method according to claim 191, wherein a plurality

of camera characteristics affecting image quality are considered to determine the representation of each object for rendering.

196. A method according to claim 195, wherein the camera characteristics affecting quality are considered in a predetermined order and values for each respective camera characteristic are compared, with the determination of the representations to be rendered being made once the tests identify a characteristic which differs by more than a predetermined amount for given cameras.

197. A method according to claim 191, further comprising the step of generating a signal conveying the image data.

198. A method according to claim 197, further comprising the step of recording the signal.

199. A method according to claim 191, further comprising the step of displaying an image of the objects using the generated image data.

200. A method according to claim 191, further comprising the step of making a recording of the image data either directly or indirectly.

201. An image processing method in which image data from

each of a respective sequence of images, each from a different camera, is processed to define a representation of at least one object in a three-dimensional computer model, and wherein a representation of each object is selected for rendering in dependence upon a user-selected viewing direction, the viewing direction of each camera and at least one camera parameter related to image data quality.

202. An image processing method in which a user-selected viewing direction in accordance with which an image of at least one object in a three-dimensional computer model is to be rendered is used to select, from among image data defining a plurality of images of the object each recorded by a respective camera, image data to be used to define the object in the three-dimensional computer model, the selection being carried out in dependence upon the user-selected viewing direction, together with the viewing direction of each camera and at least one camera parameter related to image data quality.

203. An image processing apparatus for processing image data defining a plurality of sequences of images, each from a respective camera, of at least one object moving in a scene to produce signals defining a representation of each object in a three-dimensional computer model, and to generate image data by rendering an image of the

three-dimensional computer model in accordance with a user-selected viewing direction, the apparatus comprising:

means for processing input image data from at least one camera to define at least one representation of each object in the three-dimensional computer model; and

means for generating image data by rendering an image of the three-dimensional computer model in accordance with the user-selected viewing direction, in which texture data based on input image data is rendered onto a representation of each object;

the apparatus being operable to perform processing such that:

the representation of each object rendered is determined in dependence upon the user-selected viewing direction, the respective viewing directions of cameras, and at least one camera characteristic affecting image data quality.

204. Apparatus according to claim 203, operable to perform processing such that the representation of each object rendered is determined in dependence upon the user-selected viewing direction, the viewing direction of respective cameras, and at least one of: the methods of transferring the image data from respective cameras; the resolution of respective cameras; the shutter speed of respective cameras; the stability of the image data

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from respective cameras; and whether the image data from respective cameras is colour or black and white.

205. Apparatus according to claim 203, operable to perform processing such that, when the user-selected viewing direction is input prior to the object representations being defined, one representation of each object is defined using the image data from one camera, the one camera being selected in dependence upon the user-selected viewing direction, the viewing direction of respective cameras, and at least one camera characteristic affecting image data quality.

206. Apparatus according to claim 203, operable to perform processing such that image data from a first camera is processed to define a first representation of each object in the three-dimensional computer model, image data from a second camera is processed to define a second representation of each object in the three-dimensional computer model, and either the first representations or the second representations are selected for rendering in dependence upon the user-selected viewing direction, the viewing direction of the first and second cameras, and at least one camera characteristic affecting image data quality.

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207. Apparatus according to claim 203, operable to

perform processing such that a plurality of camera characteristics affecting image quality are considered to determine the representation of each object for rendering.

208. Apparatus according to claim 207, operable to perform processing such that the camera characteristics affecting quality are considered in a predetermined order and values for each respective camera characteristic are compared, with the determination of the representations to be rendered being made once the tests identify a characteristic which differs by more than a predetermined amount for given cameras.

209. Apparatus according to claim 203, further comprising means for displaying an image of the objects using the generated image data.

210. An image processing apparatus operable to process image data from each of a respective sequence of images, each from a different camera, to define a representation of at least one object in a three-dimensional computer model, and to select a representation of each object for rendering in dependence upon a user-selected viewing direction, the viewing direction of each camera and at least one camera parameter related to image data quality.

211. An image processing apparatus operable to use a user-selected viewing direction in accordance with which an image of at least one object in a three-dimensional computer model is to be rendered to select, from among image data defining a plurality of images of the object each recorded by a respective camera, image data to be used to define the object in the three-dimensional computer model, the selection being carried out in dependence upon the user-selected viewing direction, together with the viewing direction of each camera and at least one camera parameter related to image data quality.

212. A storage medium storing instructions for causing a programmable processing apparatus to perform a method according to ~~any of~~ claims 191 ~~to 202~~.

213. A signal conveying instructions for causing a programmable processing apparatus to perform a method according to ~~any of~~ claims 191 ~~to 202~~.

214. A method of processing image data defining a plurality of sequences of images, each from a respective camera, of an object moving in a scene to produce signals defining a representation of the object in a three-dimensional computer model, and to generate image data for first and second images in a sequence of images of

the object by rendering images of the three-dimensional computer model in accordance with first and second user-selected viewing directions, the method comprising:

processing the image data to define at least one representation of the object in the three-dimensional computer model;

generating image data for use in a first image in the sequence by rendering texture data based on image data from at least a first of the cameras onto a representation of the object in accordance with a first user-selected viewing direction;

generating image data for use in a second image in the sequence by rendering texture data based on image data from a second of the cameras onto a representation of the object in accordance with a second user-selected viewing direction;

testing whether first and second images of the object displayed from the generated image data will be discontinuous by testing whether the image data for the object in the second image in the sequence differs by more than a predetermined amount from predetermined image data; and

if the image data for the object in the second image differs by more than the predetermined amount, generating modified image data for the object in the second image.

215. A method according to claim 214, wherein:

in the step of processing the image data, image data from the first camera is processed to generate a first representation of the object in the three-dimensional computer model, and image data from the second camera is processed to generate a second representation of the object in the three-dimensional computer model;

the image data for the object in the first image is generated by rendering the first representation; and

the image data for the object in the second image is generated by rendering the second representation.

216. A method according to claim 215, wherein, in the step of testing:

further image data for the object in the second image in the sequence is generated by rendering texture data based on image data from the first camera onto the first representation of the object in accordance with the second user-selected viewing direction; and

the image data for the object in the second image generated using image data from the second camera is compared with the image data for the object in the second image generated using image data from the first camera.

217. A method according to claim 216, wherein in the step of generating modified image data, the modified image data is generated in dependence upon the image data for the object in the second image generated using image data

from the second camera and the image data for the object in the second image generated using image data from the first camera.

218. A method according to claim 214, wherein:

the step of generating image data for the first image comprises rendering the three-dimensional computer model in accordance with the first user-selected viewing direction;

the step of generating image data for the second image comprises rendering the three-dimensional computer model in accordance with the second user-selected viewing direction; and

the step of testing comprises comparing the rendered image data for the second image with the predetermined image data.

219. A method according to claim 214, further comprising the step of generating a signal conveying the modified image data.

220. A method according to claim 219, further comprising the step of recording the signal.

221. A method according to claim 214, further comprising the step of displaying an image of the object using the modified image data.

222. A method according to claim 214, further comprising the step of making a recording of the modified image data either directly or indirectly.

223. A method of generating image data for first and second images in a sequence of images by rendering a three-dimensional computer model in accordance with respective first and second user-selected viewing directions, the three-dimensional computer model comprising a representation and associated texture data for at least one object and the texture data comprising texture data derived from image data recorded by a first camera and texture data derived from image data recorded by a second camera, the method comprising:

generating image data for use in a first image in the sequence by rendering texture data based on image data from at least a first camera onto the representation of each object in accordance with the first user-selected viewing direction;

generating image data for use in the second image in the sequence by rendering texture data based on image data from the second camera onto the representation of each object in accordance with a second user-selected viewing direction;

testing whether first and second images of the object displayed from the generated image data will be discontinuous by testing whether the image data for the

object in the second image in the sequence differs by more than a predetermined amount from predetermined image data; and

if the image data for the object in the second image differs by more than the predetermined amount, generating modified image data for the object in the second image.

224. An image processing method in which a three-dimensional computer model including at least one representation of an object is processed a first time to generate image data for a first image in a sequence of images by rendering using image data recorded by a first camera as the basis for texture data for a representation, and a second time to generate image data for a successive image in the sequence by rendering using image data recorded by a second camera as the basis for texture data for a representation, and modified image data is generated for the object in the successive image if image data comparison tests indicate that the object in the images in the sequence will appear discontinuous.

225. A method of generating image data for successive images in a sequence by rendering a representation of an object in a three-dimensional computer model using image data from a plurality of cameras, in which a test on the image data is performed to determine whether the image of the object will appear discontinuous in the successive

images, and the image data is processed to reduce the discontinuity.

226. Image processing apparatus for processing image data defining a plurality of sequences of images, each from a respective camera, of an object moving in a scene to produce signals defining a representation of the object in a three-dimensional computer model, and to generate image data for first and second images in a sequence of images of the object by rendering images of the three-dimensional computer model in accordance with first and second user-selected viewing directions, the apparatus comprising:

means for processing the image data to define at least one representation of the object in the three-dimensional computer model;

means for generating image data for use in a first image in the sequence by rendering texture data based on image data from at least a first of the cameras onto a representation of the object in accordance with a first user-selected viewing direction;

means for generating image data for use in a second image in the sequence by rendering texture data based on image data from a second of the cameras onto a representation of the object in accordance with a second user-selected viewing direction;

means for testing whether first and second images

of the object displayed from the generated image data will be discontinuous by testing whether the image data for the object in the second image in the sequence differs by more than a predetermined amount from predetermined image data; and

means for generating modified image data for the object in the second image if the image data for the object in the second image differs by more than the predetermined amount.

227. Apparatus according to claim 226, wherein:

the means for processing the image data is operable to process image data from the first camera to generate a first representation of the object in the three-dimensional computer model, and to process image data from the second camera to generate a second representation of the object in the three-dimensional computer model; and

the apparatus is arranged to perform processing such that:

- the image data for the object in the first image is generated by rendering the first representation; and

- the image data for the object in the second image is generated by rendering the second representation.

228. Apparatus according to claim 227, wherein the means for testing is operable to perform processing such that:

further image data for the object in the second image in the sequence is generated by rendering texture data based on image data from the first camera onto the first representation of the object in accordance with the second user-selected viewing direction; and

the image data for the object in the second image generated using image data from the second camera is compared with the image data for the object in the second image generated using image data from the first camera.

229. Apparatus according to claim 228, wherein the means for generating modified image data is arranged to perform processing such that the modified image data is generated in dependence upon the image data for the object in the second image generated using image data from the second camera and the image data for the object in the second image generated using image data from the first camera.

230. Apparatus according to claim 226, wherein:

the means for generating image data for the first image comprises means for rendering the three-dimensional computer model in accordance with the first user-selected viewing direction;

the means for generating image data for the second image comprises means for rendering the three-dimensional computer model in accordance with the second user-selected viewing direction; and

the means for testing comprises means for comparing the rendered image data for the second image with the predetermined image data.

231. Apparatus according to claim 226, further comprising means for displaying an image of the object using the modified image data.

232. Image processing apparatus for generating image data for first and second images in a sequence of images by rendering a three-dimensional computer model in accordance with respective first and second user-selected viewing directions, the three-dimensional computer model comprising a representation and associated texture data for at least one object and the texture data comprising texture data derived from image data recorded by a first camera and texture data derived from image data recorded by a second camera, the apparatus comprising:

means for generating image data for use in a first image in the sequence by rendering texture data based on image data from at least a first camera onto the representation of each object in accordance with the first user-selected viewing direction;

means for generating image data for use in the second image in the sequence by rendering texture data based on image data from the second camera onto the representation of each object in accordance with a second

user-selected viewing direction;

means for testing whether first and second images of the object displayed from the generated image data will be discontinuous by testing whether the image data for the object in the second image in the sequence differs by more than a predetermined amount from predetermined image data; and

means for generating modified image data for the object in the second image if the image data for the object in the second image differs by more than the predetermined amount.

233. An image processing apparatus operable to process a three-dimensional computer model including at least one representation of an object a first time to generate image data for a first image in a sequence of images by rendering using image data recorded by a first camera as the basis for texture data for a representation, and a second time to generate image data for a successive image in the sequence by rendering using image data recorded by a second camera as the basis for texture data for a representation, and operable to generate modified image data for the object in the successive image if image data comparison tests indicate that the object in the images in the sequence will appear discontinuous.

234. Apparatus for method of generating image data for

successive images in a sequence by rendering a representation of an object in a three-dimensional computer model using image data from a plurality of cameras, the apparatus being operable to perform a test on the image data to determine whether the image of the object will appear discontinuous in the successive images, and to process the image data to reduce the discontinuity.

235. A storage medium storing instructions for causing a programmable processing apparatus to perform a method according to ~~any of~~ claims 214 ~~to 225~~.

236. A signal conveying instructions for causing a programmable processing apparatus to perform a method according to ~~any of~~ claims 214 ~~to 225~~.

237. An image processing apparatus for processing image data defining a plurality of sequences of images, each from a respective camera, of a plurality of objects moving in a scene to produce signals defining representations of the objects in a three-dimensional computer model, the apparatus comprising:

an image data identifier for processing image data from a first of the cameras to identify image data relating to objects in the scene, and for processing image data from a second of the cameras to identify image

data relating to objects in the scene;

an object representation definer for processing the identified image data from the first camera for each object to define an object representation in a modelling space having a height dependent upon the image data for the object from the first camera, and for processing the identified image data from the second camera for each object to define an object representation in the modelling space having a height dependent upon the image data for the object from the second camera;

a height comparer for comparing the height of the representation of each object generated in dependence upon image data from the first camera with the height of the representation of the corresponding object generated in dependence upon image data from the second camera; and

an object representation generator for generating object representations in the three-dimensional computer model in dependence upon the height comparisons.

238. Apparatus for processing image data defining a plurality of sequences of images, each from a respective camera, of an object moving in a scene to produce signals defining a representation of the object in a three-dimensional computer model, the apparatus comprising:

an image data identifier for processing image data from a first of the cameras to identify image data relating to the object in the scene, and for processing

image data from a second of the cameras to identify image data relating to the object in the scene;

an image data transformer for applying a transformation to the identified image data from the first camera which defines a mapping from the ground plane in the space of the image data of the first camera to a surface in a modelling space, and for applying a transformation to the identified image data from the second camera which defines a mapping from the ground plane in the space of the image data of the second camera to the surface in the modelling space;

an image data comparer for comparing the transformed image data from the first and second cameras on the surface in the modelling space;

a shadow determinator for determining which part of the image data represents shadow in dependence upon the comparison results; and

an object representation generator for generating a representation of at least the object in the three-dimensional model.

239. Apparatus for generating a model of an object in a three-dimensional computer model, comprising:

an image data transformer for applying a transformation to image data from a first camera relating to the object and its shadow which maps the image data for one of the object and its shadow to a surface, and

for applying a transformation to image data from a second camera relating to the object and its shadow which maps the image data for one of the object and its shadow to the surface; and

an object modeller for modelling the object in dependence upon part of the transformed image data.

240. Apparatus for processing image data defining a plurality of sequences of images, each from a respective camera, of an object moving in a scene to produce signals defining a representation of the object in a three-dimensional computer model, the apparatus comprising:

an image data identifier for processing image data from a first of the cameras to identify image data relating to the object in the scene, and for processing image data from a second of the cameras to identify image data relating to the object in the scene;

a footprint determinator for processing the identified image data from the first camera and the identified image data from the second camera to determine a footprint of the object on the ground; and

an object modeller for defining a model of the object in the three-dimensional computer model in dependence upon the determined footprint.

241. Apparatus for processing image data defining a sequence of images of a plurality of objects moving in

a scene to produce signals defining representations of the objects in a three-dimensional computer model, and to generate image data by rendering an image of the three-dimensional computer model in accordance with a user-selected viewing direction, the apparatus comprising:

an image data identifier for processing the image data to identify image data relating to respective objects in the scene;

an object modeller for defining a representation of each object in the three-dimensional computer model, in dependence upon the identified image data; and

a renderer for generating image data by rendering an image of the three-dimensional computer model in accordance with a user-selected viewing direction, operable such that, when the selected viewing direction is within a predetermined range of viewing directions, texture data based on the identified image data is rendered onto the object representations, and, when the selected viewing direction is not within the predetermined range of viewing directions, a schematic of the positions of the objects in the scene is rendered.

242. Apparatus for rendering an image in accordance with a user-selected viewing direction of a three-dimensional computer model comprising a representation and associated texture data for an object, the texture data being

a quality information generator for generating quality information for the image data indicating a quality of the image data determined in dependence upon the user-selected viewing direction.

245. Apparatus for rendering an image in accordance with a user-selected viewing direction of a three-dimensional computer model comprising a representation and associated texture data for at least one object, the texture data being derived from image data recorded by at least one camera, the apparatus comprising:

a renderer for generating image data by rendering an image of the three-dimensional computer model in accordance with a user-selected viewing direction, in which the texture data is rendered onto each representation; and

a quality data generator for generating quality information for the image data indicating a quality of the image data determined in dependence upon the user-selected viewing direction.

246. An image processing apparatus for processing image data defining a plurality of sequences of images, each from a respective camera, of at least one object moving in a scene to produce signals defining a representation of each object in a three-dimensional computer model, and to generate image data by rendering an image of the

derived from image data recorded by at least one camera, the apparatus comprising:

a first renderer for rendering the texture data onto the representation for the object in accordance with the user-selected viewing direction when the user-selected viewing direction is within a predetermined range of viewing directions; and

a second renderer for rendering a schematic of the positions of the object when the user-selected viewing direction is not within the predetermined range of viewing directions.

243. Apparatus for processing image data defining a plurality of sequences of images, each from a respective camera, of an object moving in a scene to produce signals defining a representation of the object in a three-dimensional computer model, the apparatus comprising:

an image data identifier for processing image data from a first of the cameras to identify image data relating to the object in the scene, and for processing image data from a second of the cameras to identify image data relating to the object in the scene;

a surfacer identifier for processing the identified image data from the first camera and the identified image data from the second camera to identify planar surfaces on which points on the object lie, comprising a feature matcher for matching feature points in the identified

image data from the first camera with feature points in the identified image data from the second camera, and a planar surface identifier for identifying planar surfaces on which matched feature points lie; and

an object modeller for defining a model of the object in the three-dimensional computer model in dependence upon the identified planar surfaces.

244. Apparatus for processing image data defining a sequence of images of at least one object moving in a scene to produce signals defining a representation of each object in a three-dimensional computer model, and to generate image data by rendering an image of the three-dimensional computer model in accordance with a user-selected viewing direction, the apparatus comprising:

an image data identifier for processing the image data to identify image data relating to respective objects in the scene;

an object modeller for defining a representation of each object in the three-dimensional computer model in dependence upon the identified image data;

a renderer for generating image data by rendering an image of the three-dimensional computer model in accordance with a user-selected viewing direction in which texture data based on the identified image data is rendered onto the object representations; and

three-dimensional computer model in accordance with a user-selected viewing direction, the apparatus comprising:

an object representation generator for processing input image data from at least one camera to define at least one representation of each object in the three-dimensional computer model; and

a renderer for generating image data by rendering an image of the three-dimensional computer model in accordance with the user-selected viewing direction, in which texture data based on input image data is rendered onto a representation of each object;

the apparatus being operable to perform processing such that:

the representation of each object rendered is determined in dependence upon the user-selected viewing direction, the respective viewing directions of cameras, and at least one camera characteristic affecting image data quality.

247. Image processing apparatus for processing image data defining a plurality of sequences of images, each from a respective camera, of an object moving in a scene to produce signals defining a representation of the object in a three-dimensional computer model, and to generate image data for first and second images in a sequence of images of the object by rendering images of the three-

dimensional computer model in accordance with first and second user-selected viewing directions, the apparatus comprising:

an object representation generator for processing the image data to define at least one representation of the object in the three-dimensional computer model;

a renderer for generating image data for use in a first image in the sequence by rendering texture data based on image data from at least a first of the cameras onto a representation of the object in accordance with a first user-selected viewing direction, and for generating image data for use in a second image in the sequence by rendering texture data based on image data from a second of the cameras onto a representation of the object in accordance with a second user-selected viewing direction;

an image data tester for testing whether first and second images of the object displayed from the generated image data will be discontinuous by testing whether the image data for the object in the second image in the sequence differs by more than a predetermined amount from predetermined image data; and

an image data modifier for generating modified image data for the object in the second image if the image data for the object in the second image differs by more than the predetermined amount.

248. Image processing apparatus for generating image data for first and second images in a sequence of images by rendering a three-dimensional computer model in accordance with respective first and second user-selected viewing directions, the three-dimensional computer model comprising a representation and associated texture data for at least one object and the texture data comprising texture data derived from image data recorded by a first camera and texture data derived from image data recorded by a second camera, the apparatus comprising:

a renderer for generating image data for use in a first image in the sequence by rendering texture data based on image data from at least a first camera onto the representation of each object in accordance with the first user-selected viewing direction, and for generating image data for use in the second image in the sequence by rendering texture data based on image data from the second camera onto the representation of each object in accordance with a second user-selected viewing direction;

an image data tester for testing whether first and second images of the object displayed from the generated image data will be discontinuous by testing whether the image data for the object in the second image in the sequence differs by more than a predetermined amount from predetermined image data; and

an image data modifier for generating modified image data for the object in the second image if the image data

for the object in the second image differs by more than the predetermined amount.